

DC Clean Rivers

Carlton Ray, Director



Agenda

- DC Clean Rivers Background
- Project Delivery
- Anacostia River Tunnel System
- Tunnels and Geotechnical
- A Look Inside a TBM
- Potomac River Tunnel
- A Drop's Life
- Questions



DC CLEAN RIVERS BACKGROUND

DC Clean Rivers Background

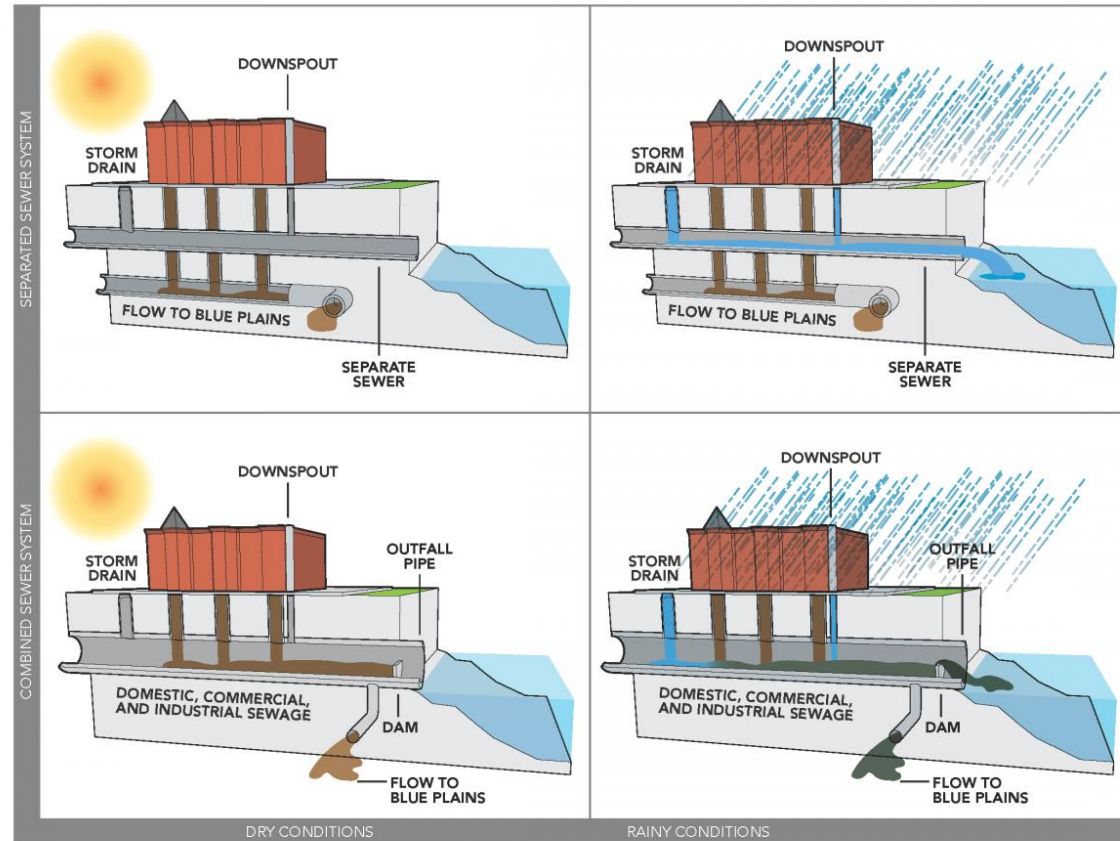
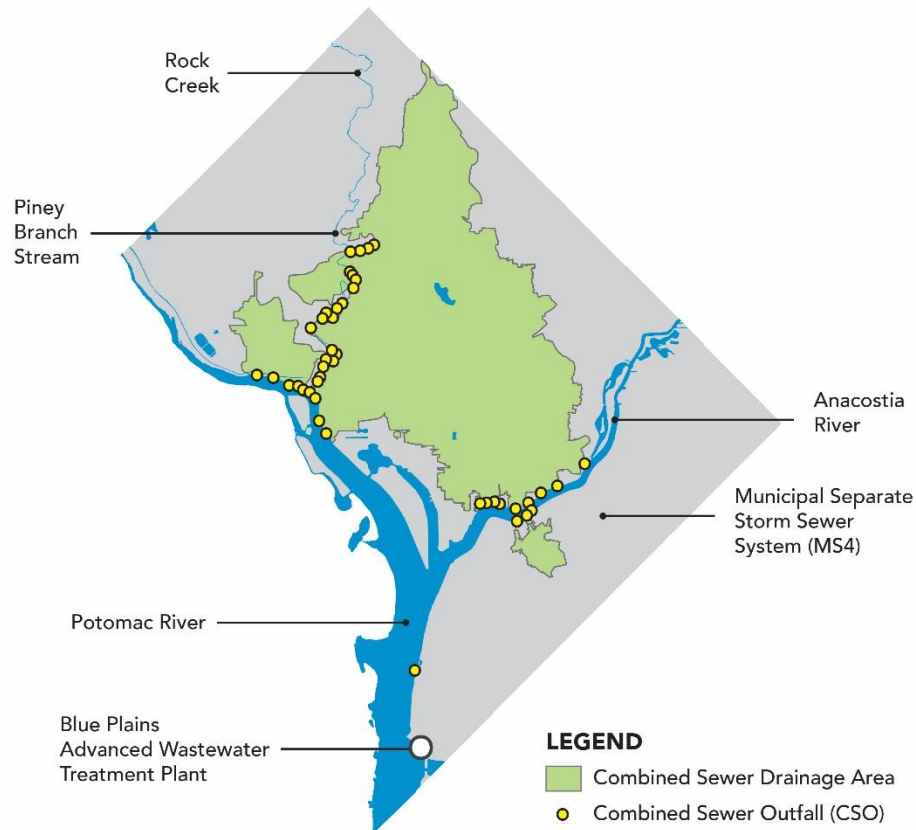
What is our Purpose?

- **Control combined sewer overflows to the:**
 - Potomac River
 - Anacostia River
 - Rock Creek
- **Relieve flooding in the Northeast Boundary Area**
- **Implemented under a Federal Consent Decree among:**
 - US Environmental Protection Agency (US EPA)/
 - US Department of Justice (US DOJ)
 - District of Columbia and
 - DC Water



DC Clean Rivers Background

Separate and Combined Sewer Systems

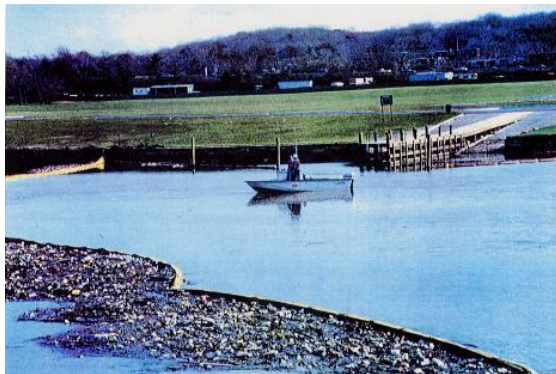


DC Clean Rivers Background Magnitude of the Challenge

Combined Sewer Overflows



CSO Discharge to Anacostia River



Trash in Anacostia River

On average, **2.1 billion gallons** of untreated sewage and stormwater runoff (combined sewage) are discharged to the Anacostia River per year.

Chronic Sewer Flooding



▲ Flooding on Mt. Olivet Rd NE



▲ Flooding on Rhode Island Ave NE



▲ Flooding on Rhode Island Ave NW



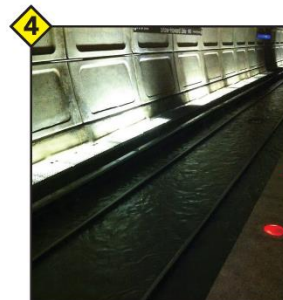
▲ Flooding on Flagler Pl NW



▲ Flooding at 1st and V Streets NW



▲ Flooding at 1st and Rhode Island Ave NW

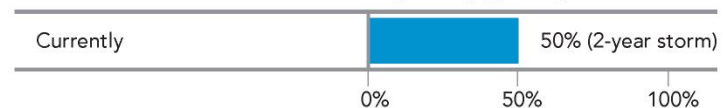


▲ Flooding at Shaw metro



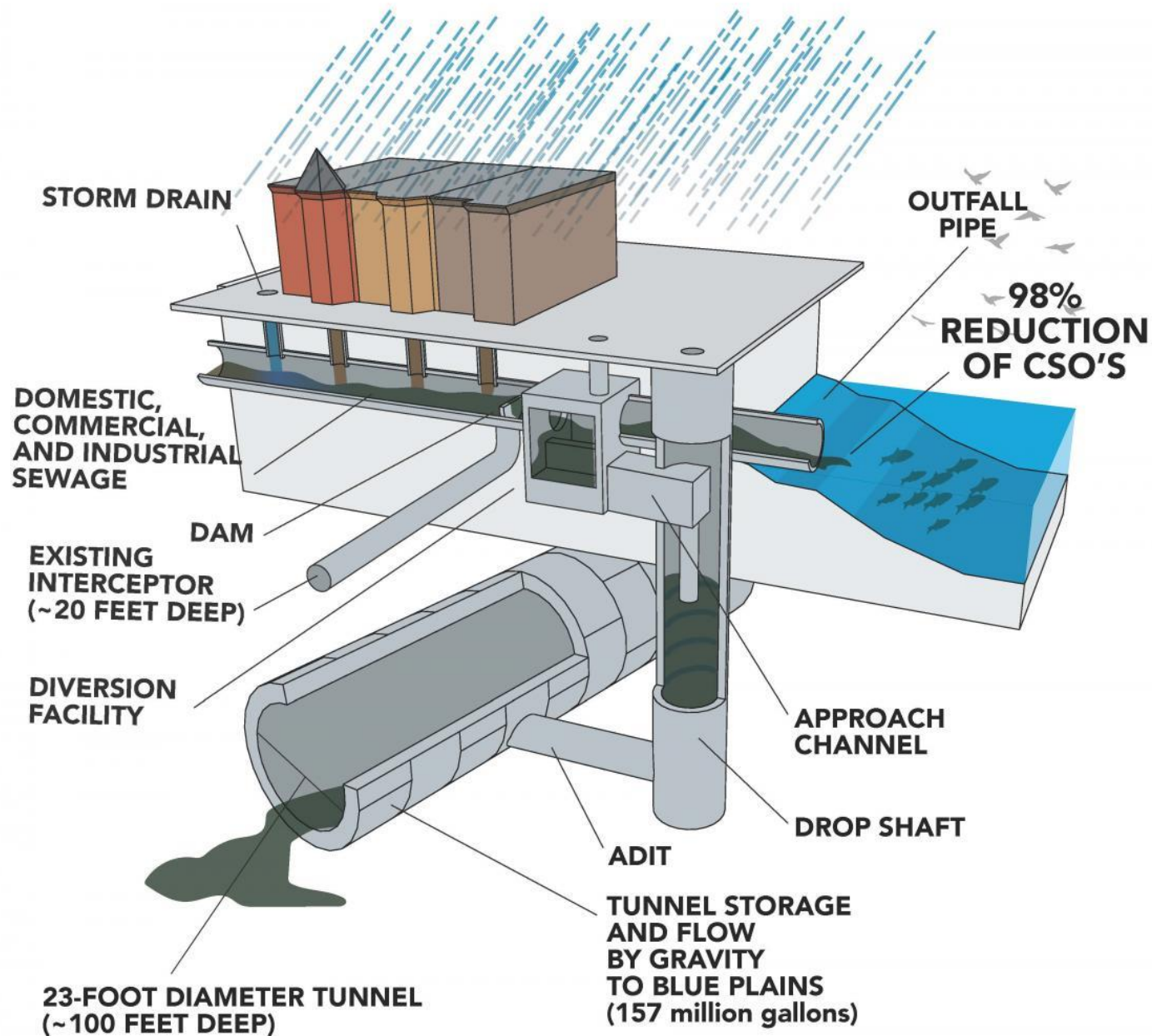
▲ Flooding at 1st and P Streets NW

Chance of flood occurring in any given year



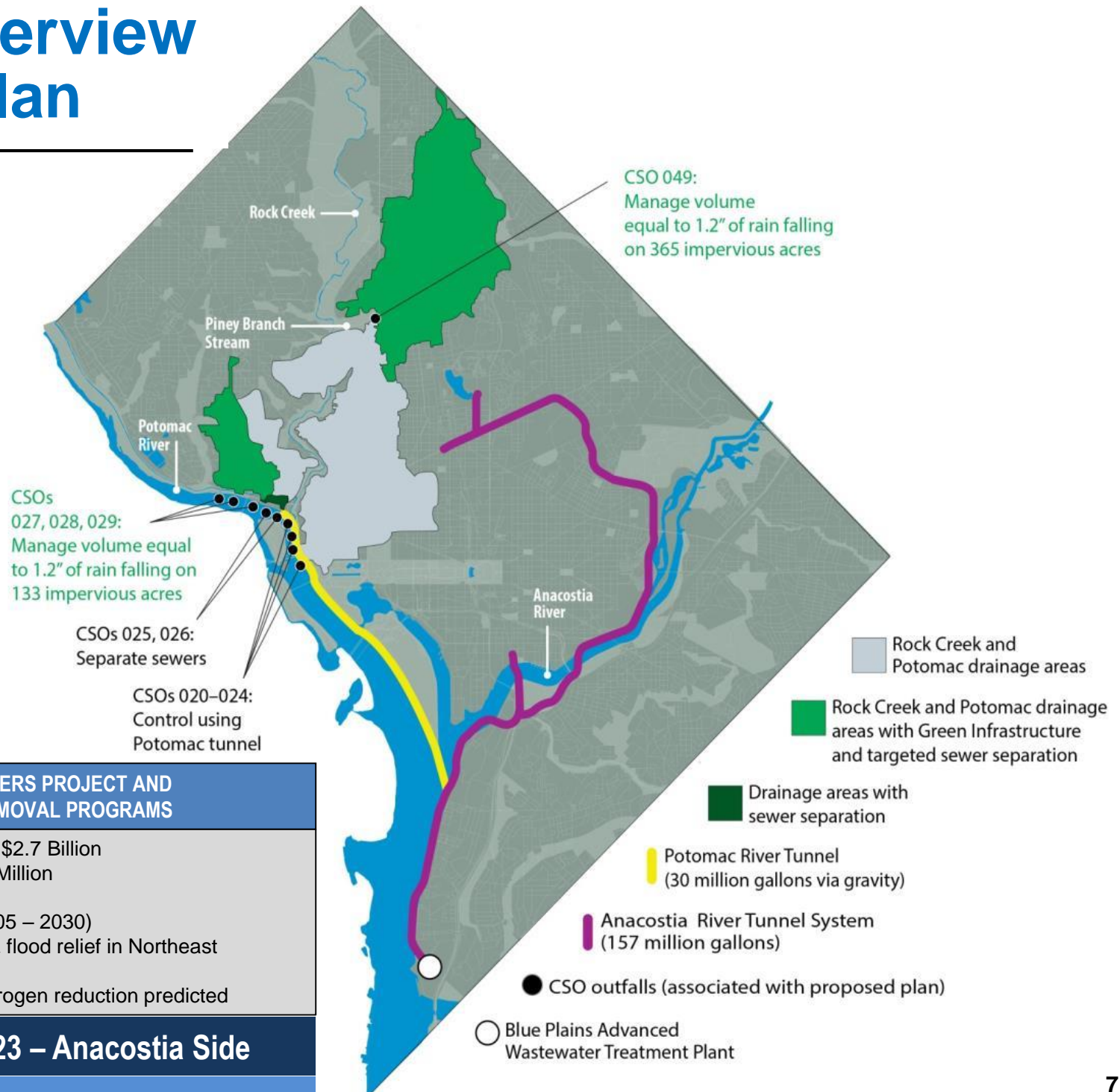
DC Clean Rivers Background

21st Century Sewer System



DCCR Overview

Current Plan



DC CLEAN RIVERS PROJECT AND NITROGEN REMOVAL PROGRAMS

- DC Clean Rivers Project: \$2.7 Billion
- Nitrogen Removal: \$950 Million
- Total > \$ 3.5 Billion
- 25 yr implementation (2005 – 2030)
- 96% reduction in CSOs & flood relief in Northeast Boundary
- Approx 1 million lbs/yr nitrogen reduction predicted

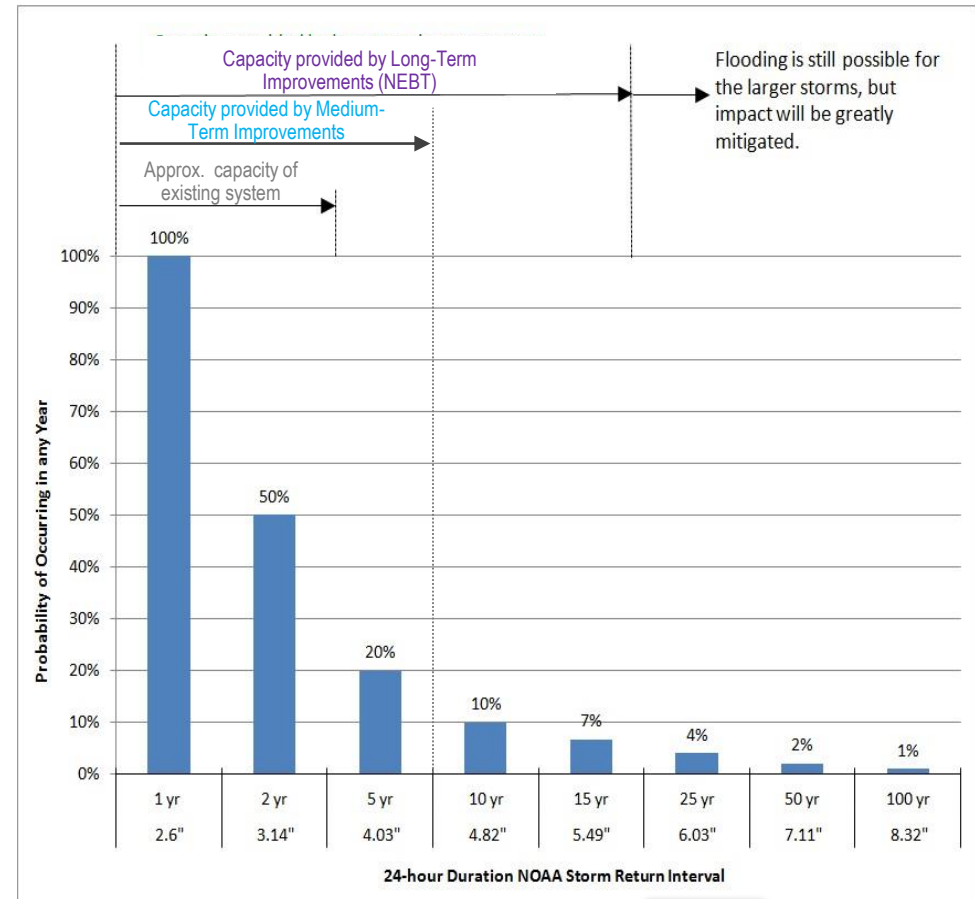
Complete by 2023 – Anacostia Side

Complete by 2030 – Potomac Side

DC Clean Rivers Background Project Benefits

- Significantly mitigate the frequency, magnitude and duration of sewer flooding and basement backups in the Northeast Boundary drainage area
- Control combined sewer overflow (CSO) discharges to the Anacostia River, significantly improving water quality
- Minimize the nuisance and economic costs associated with flooding
- Reduce risks to human health
- Greatly reduce the discharge of untreated wastewater into the District's receiving waterbodies
- Prevent deterioration of historic resources from water damage caused by flooding

Flood Relief



CSO Reduction to Anacostia River

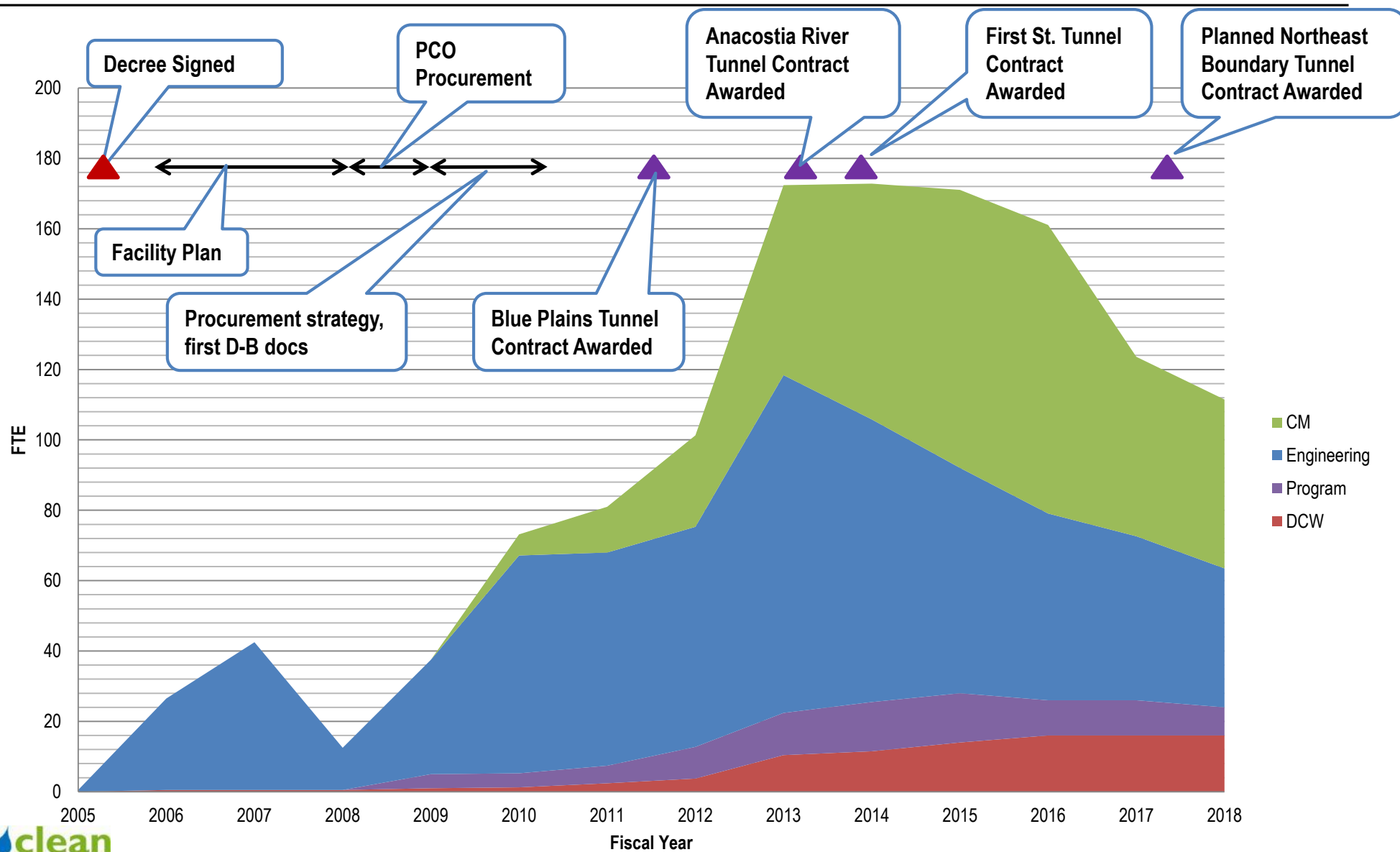
CSO Reduction Project Timeline	CSO Overflow Volume to Anacostia River (mg/yr)	% Reduction from Baseline
1996: Baseline: Without Inflatable Dams or Pumping Station Rehab	2,142	
2008: After Inflatable Dams and Pumping Station Rehab	1,282	40%
2018: Blue Plains and Anacostia River Tunnels	407	81%
2022/3: Northeast Boundary Tunnel*	54	98%

SIGNIFICANT
CSO REDUCTION

* 2025 Consent Decree Deadline; Project accelerated due to Mayor's Task Force recommendations.

PROJECT DELIVERY

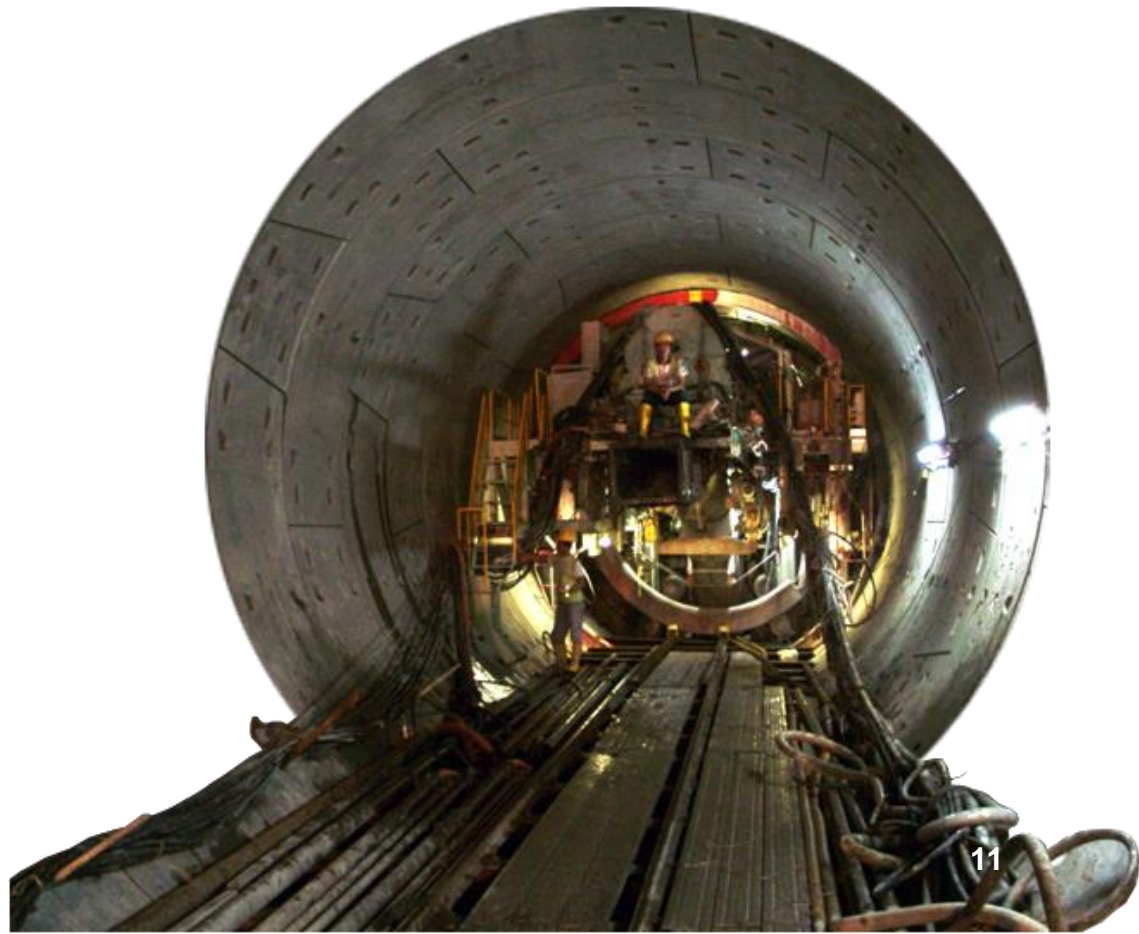
DC Clean Rivers Implementation Staff Composition vs Time



Project Delivery

Historical Delivery Methods

- DC Water has typically used traditional Design-Bid-Build (DBB) delivery process
- For DC Clean Rivers projects, DC Water considered alternative project delivery methods, recognizing:
 - Tunneling projects differ from typical DC Water CIP
 - Early contractor involvement can reduce risks
 - Consent Decree schedule was a big driver

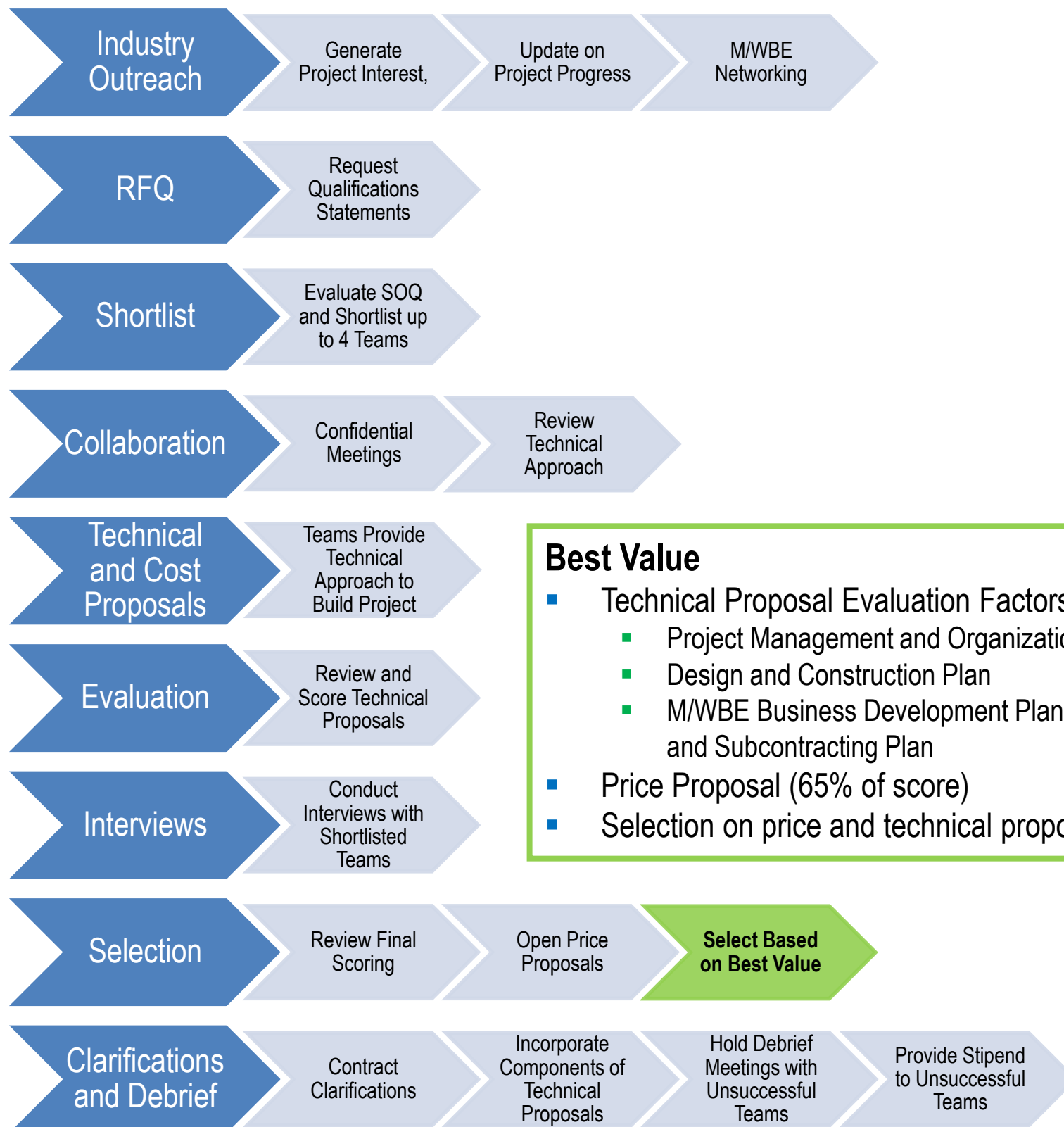


Project Delivery

Rationale for Design-Build

- Benefits from early contractor involvement:
 - Opportunity to reduce uncertainties between parties (mutual risk reduction)
 - Contractor design decisions
 - Facilitates discussing issues in a confidential setting pre-bid
 - Enhances alternative technical approaches
 - Schedule compression and flexibility
- Need for price certainty
- Price competition
- Sensitive to marketplace's concerns on risk allocation & procurement confidentiality
- Successful use of this project delivery approach elsewhere

Design-Build Procurement Process



Best Value

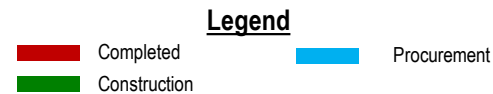
- Technical Proposal Evaluation Factors (35% of score)
 - Project Management and Organization
 - Design and Construction Plan
 - M/WBE Business Development Plan, Local Hiring Initiative and Subcontracting Plan
- Price Proposal (65% of score)
- Selection on price and technical proposal = best value

ANACOSTIA RIVER TUNNEL SYSTEM

Anacostia River Tunnel System Flyover Video



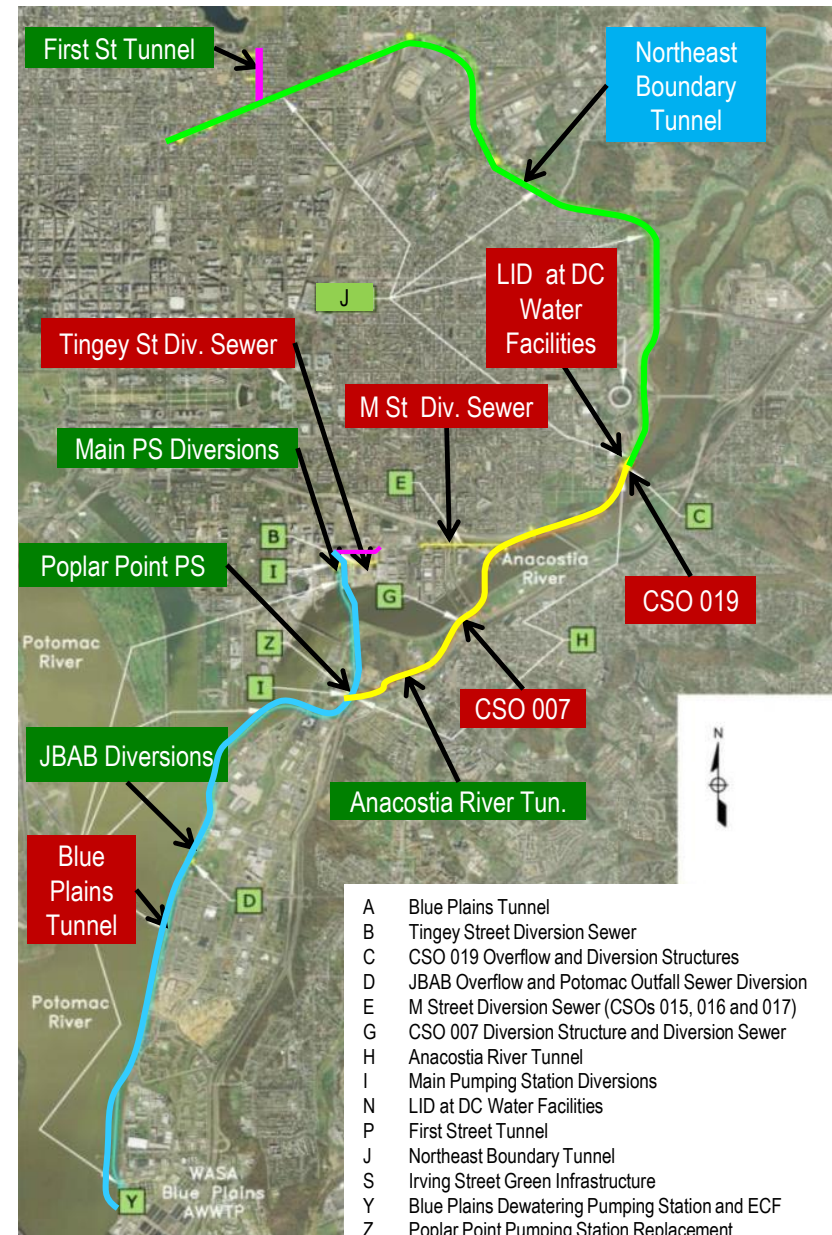
Anacostia River Tunnel System Snapshot



Project	Diameter	Length	Start	Finish
Blue Plains Tunnel	23	24,207	5/2011	12/2015
Anacostia River Tunnel	23	12,484	6/2013	12/2017
Northeast Boundary Tunnel	23	27,000	9/2017	5/2023
First Street Tunnel	20	2,700	10/2013	10/2016

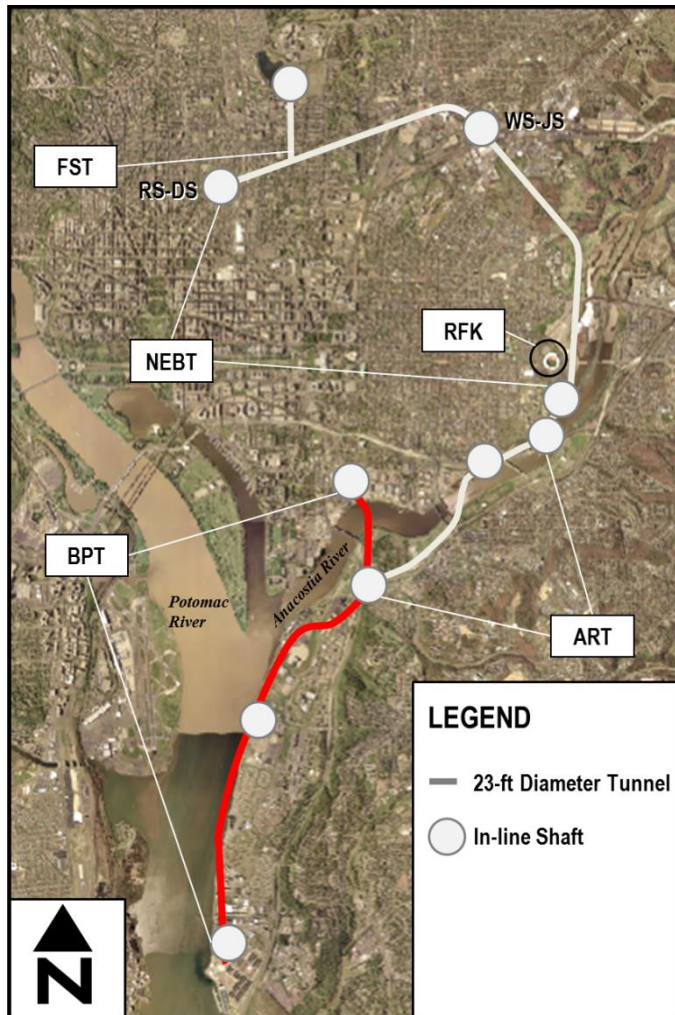
Various other contracts to connect to tunnel system

More than \$1.3 B in Contracts have been let for the Anacostia River Projects

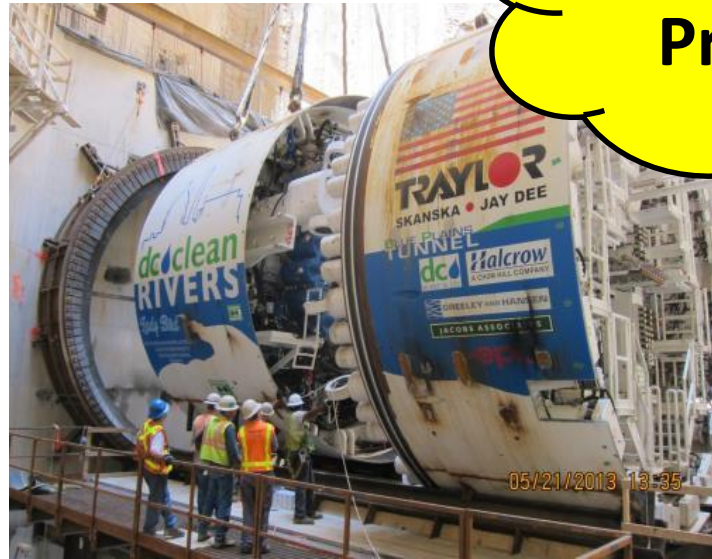


Anacostia River Tunnel System Blue Plains Tunnel

ENR "Best of
the Best" USA
Project 2016



23 feet in diameter
24,207 feet long
05/2011 to 08/2015
\$330M By Traylor-Skanska-JayDee



Assemble Lady Bird



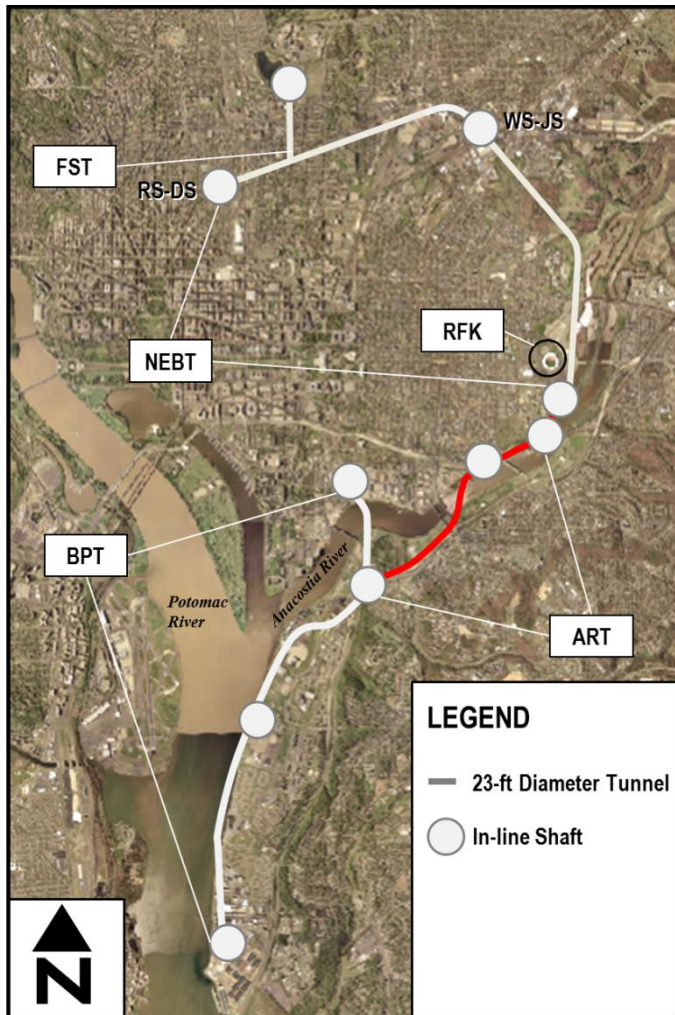
Lady Bird Emerges



Mine Tunnel

Anacostia River Tunnel System

Anacostia River Tunnel



23 feet in diameter
12,484 feet long
06/2013 to 12/2017
\$254M By Impregilo-Healy-Parsons



Celebrating the Completion of Mining



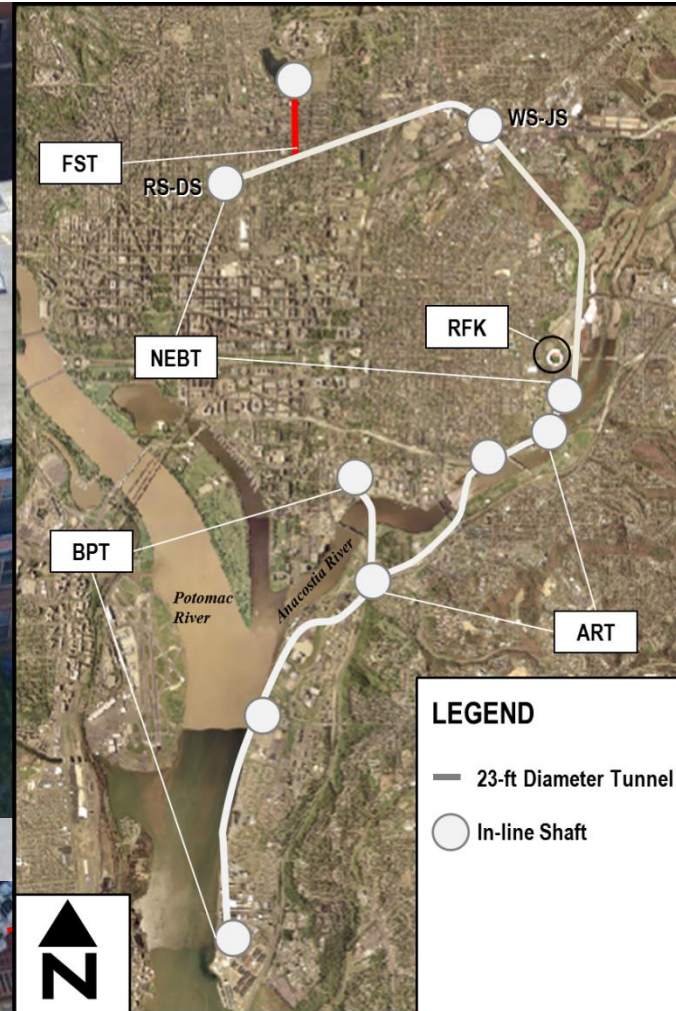
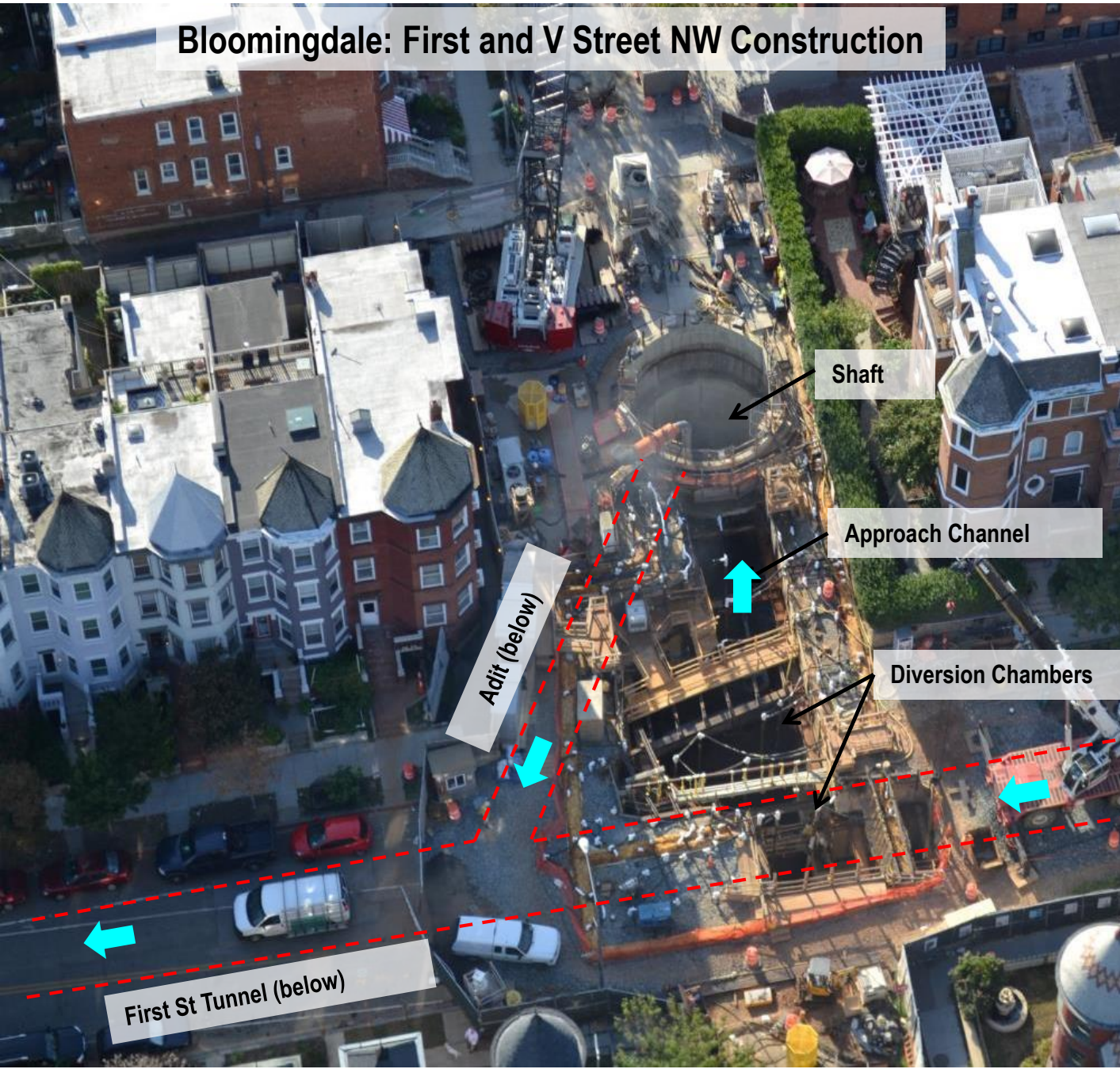
Tunnel Boring Machine, Nannie,
Lowered into Shaft to Begin Mining



M Street Shaft Excavation

Anacostia River Tunnel System First Street Tunnel

Bloomingdale: First and V Street NW Construction



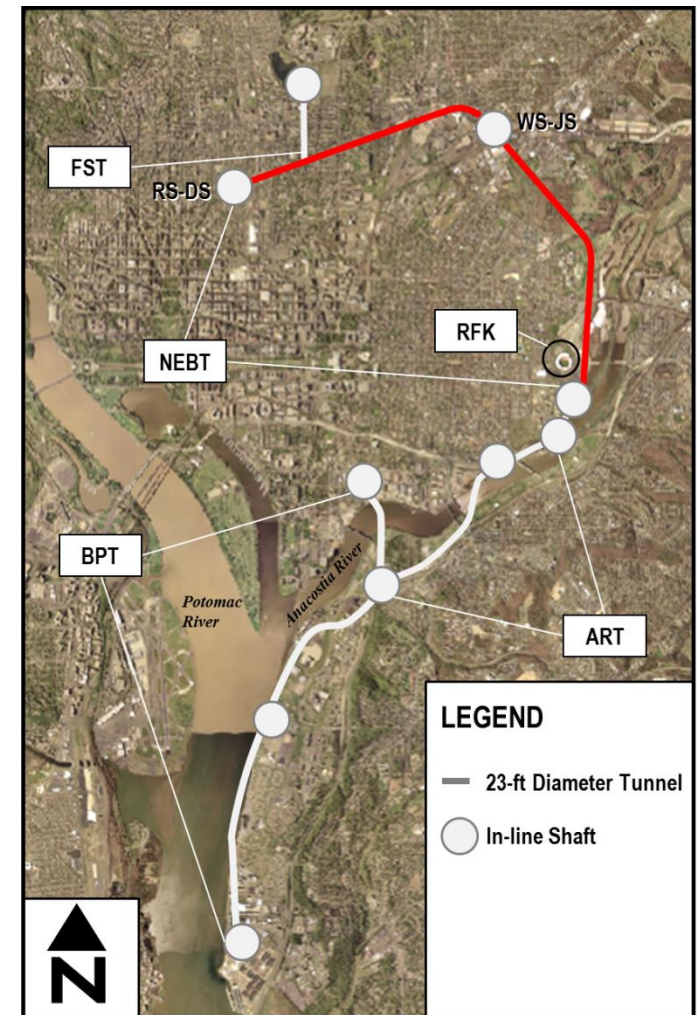
20 feet in diameter
2,700 feet long
10/2013 to Fall 2016
\$158M by Skanska-JayDee

Anacostia River Tunnel System

Northeast Boundary Tunnel

- 23 foot diameter tunnel
- 60 to 140 feet deep
- 27,000 feet long
- 7 shafts and 5 diversion chambers
- Estimated construction value: \$500 - \$600 million

Schedule	
NTP	Completion
September 2017	August 2023



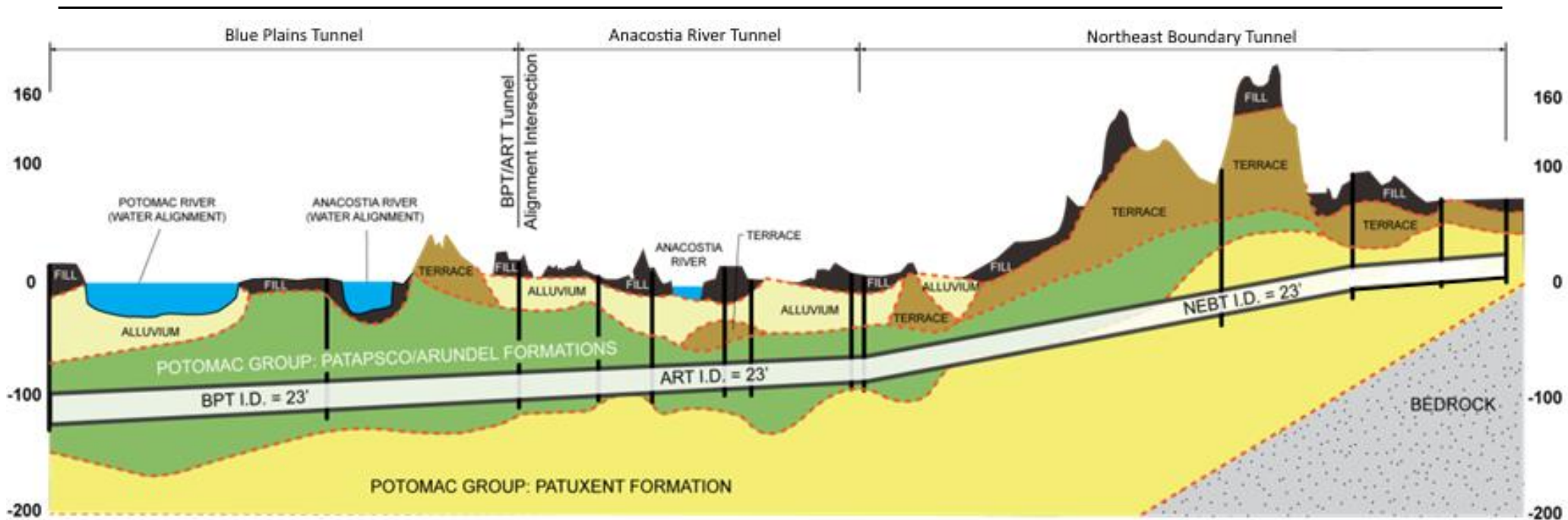
TUNNELS AND GEOTECHNICAL

Horizontal Alignment

1. Near existing CSO's and pumping stations
2. Away from U/G features
 1. NRL Pier
 2. DOD storm sewers
3. Space for Intermediate shafts
4. Follow public rights-of-way
5. Crossing RR at right angles
6. Minimum $R = 900 \pm$
7. Tangents in/out of shafts

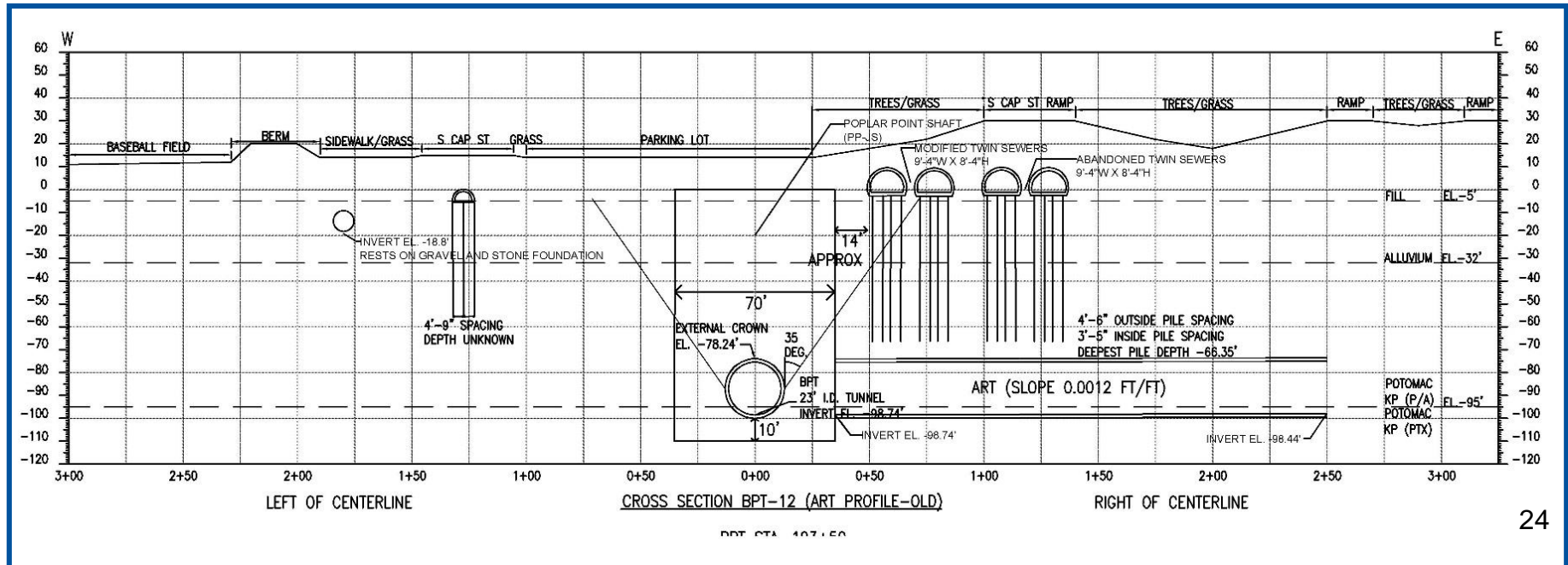
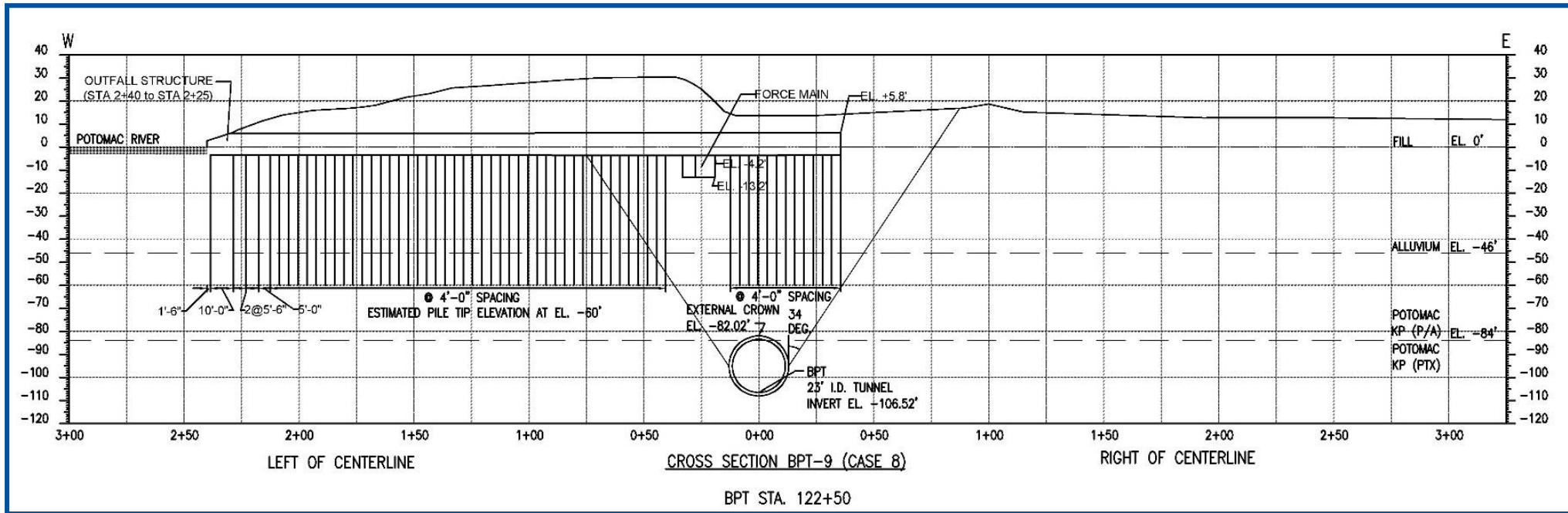


Vertical Alignment



1. Pump Station at Blue Plains
2. Minimum Grade = 0.1%
3. Depth determined by going under obstructions
 1. Bridges
 2. DC Water and DOD sewers –many on piles
4. Working depth limited to 3 bars of water
5. Did not “chase the good ground”

Example of Underground Analysis:



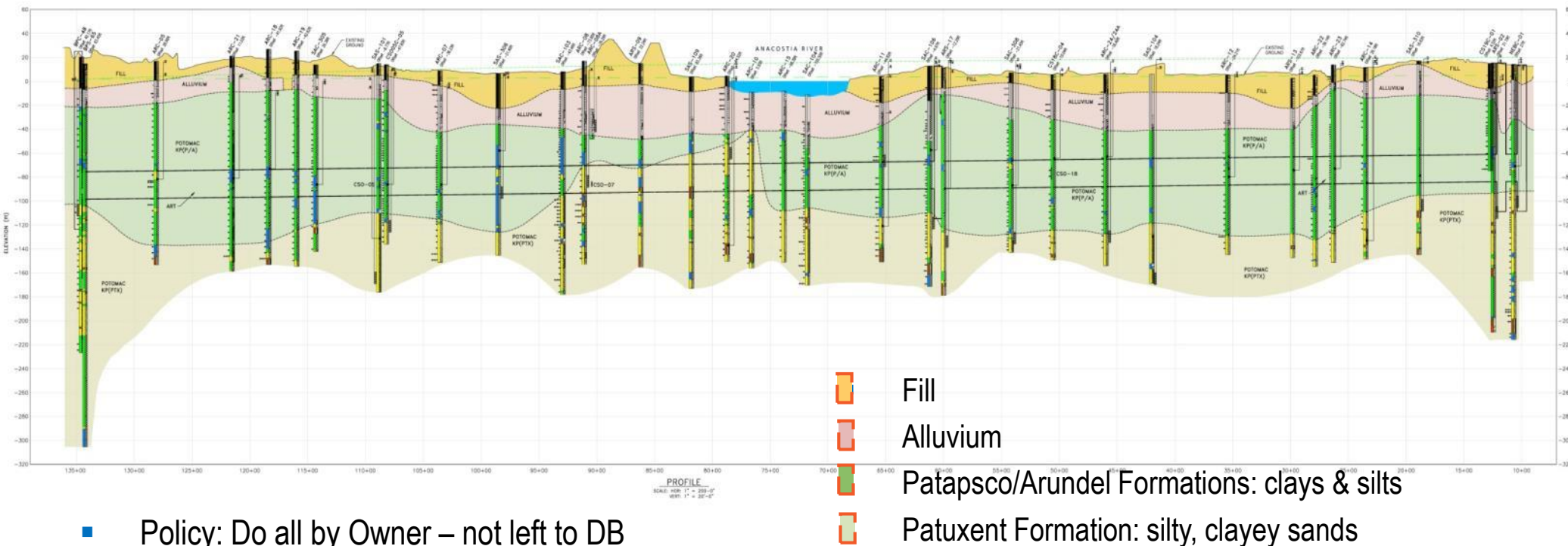
Geologic Investigations

Program Wide

Tunnel	Blue Plains	Anacostia River	Northeast Boundary	First Street
Tunnel Length (ft)	24,207	12,484	27,000	2,624
Number of Shafts	5	6	7	4
Contract Values	\$330M	\$254M	\$500M-\$600M	\$158M
Borings	102	61	131	10
Total Boring Length (ft)	17140	9695	19647	1530
Environmental Samples	76	100	161	47
Geotechnical Samples	1166	696	1337	125
Drilling Cost	\$ 6,200,000	\$ 4,100,000	\$ 8,000,000	\$ 620,000
Laboratory Cost	\$ 305,000	\$ 230,000	\$ 415,000	\$ 70,000
Oversight and Reporting Cost	\$ 3,200,000	\$ 1,600,000	\$ 3,400,000	\$ 300,000

Geologic Investigations

(Example: Anacostia River Tunnel)



- Policy: Do all by Owner – not left to DB
 - They could request more, and did
- Borings spaced at 600-foot +/- along tunnel, 2D below
- Several at each shaft, 1D below
- Pump Tests at Blue Plains and RFK Stadium
- Flowing artesian pressures north of the Anacostia River ranges from EL +14 to EL +20

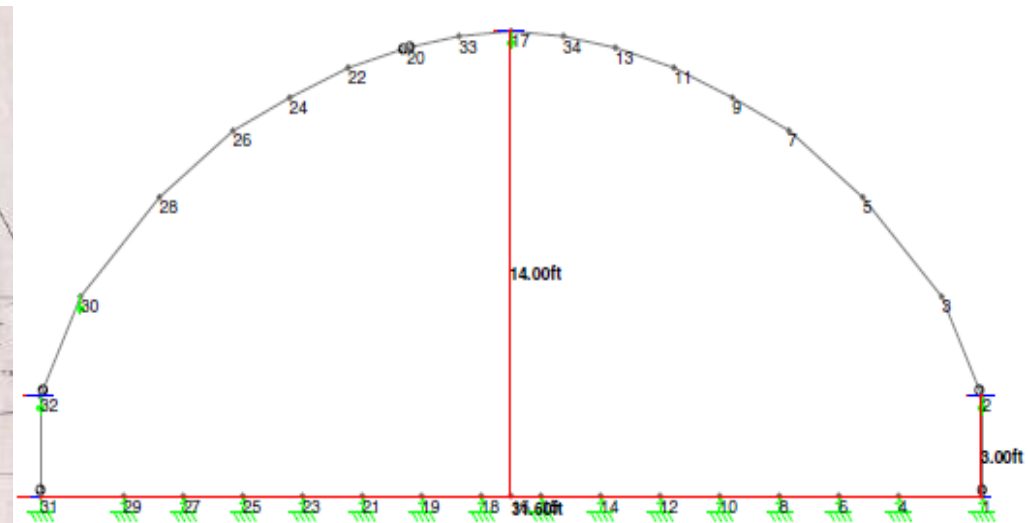
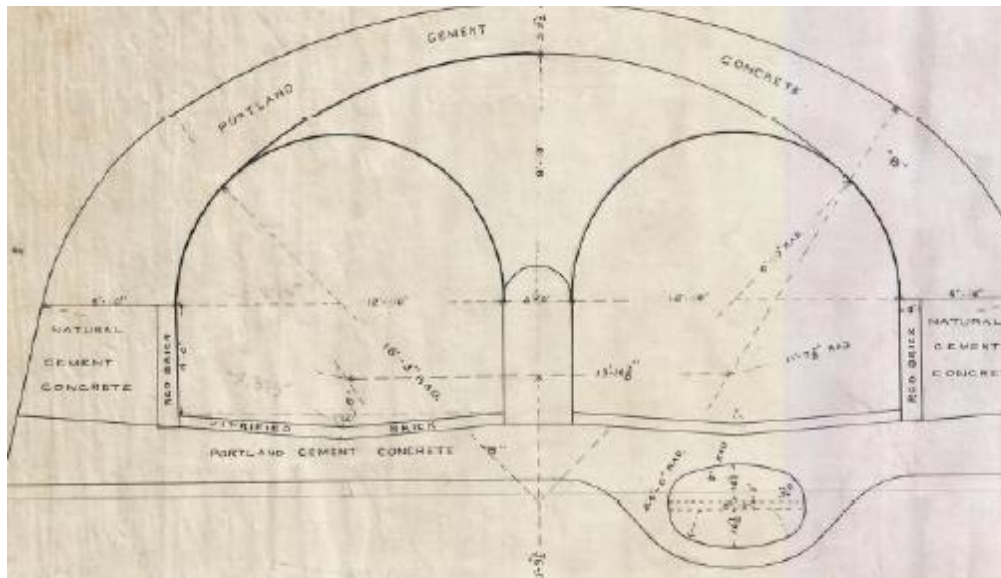
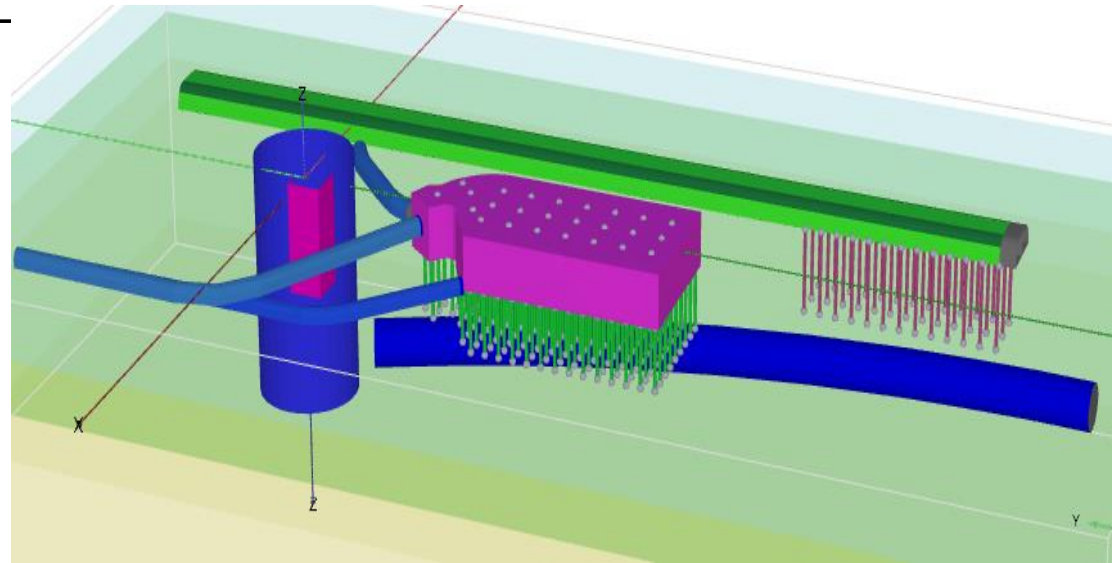
RFP Documents

Geotechnical

- GBR
 - Tunnel: Set baselines for soil properties, abrasivity, obstructions (man made or natural), strength, stickiness, swelling/squeezing
 - Shafts: contact elevations, ground water elevation, obstruction volume
 - Environmental baselines: depth/level of contamination
- GDR
 - Boring logs
 - Lab results
 - Groundwater/soil chemistry
- Contract Documents:
 - Functional baselines for intervention time required to maintain the cutterhead due to wear
 - This is an indirect measurement of abrasivity which is hard to directly quantify in the field

Protection of Structures

- RFP Documents Identified Utilities and Structures
- CIAR requires extensive analyses
 - Modeling Soil Movements
 - Structural Modeling



Protection of Structures

- Mitigation measures
 - Ground Improvement
 - Structural Rehabilitation



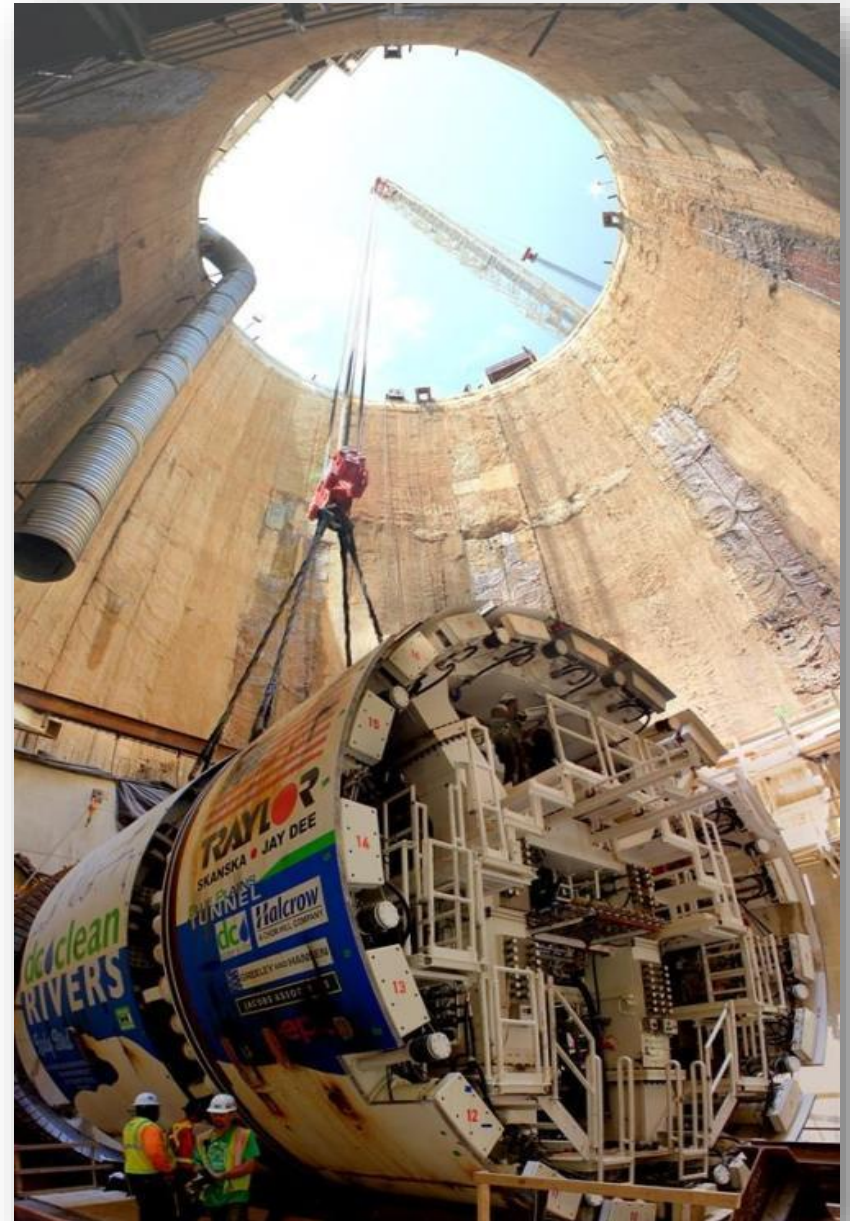
- Payment Approach
 - Engineering in LS
 - Allowance Item for Construction

A LOOK INSIDE AN EARTH PRESSURE BALANCE (EPB) TUNNEL BORING MACHINE (TBM)

A Look Inside a TBM Lady Bird



A Look Inside a TBM Assembling Lady Bird

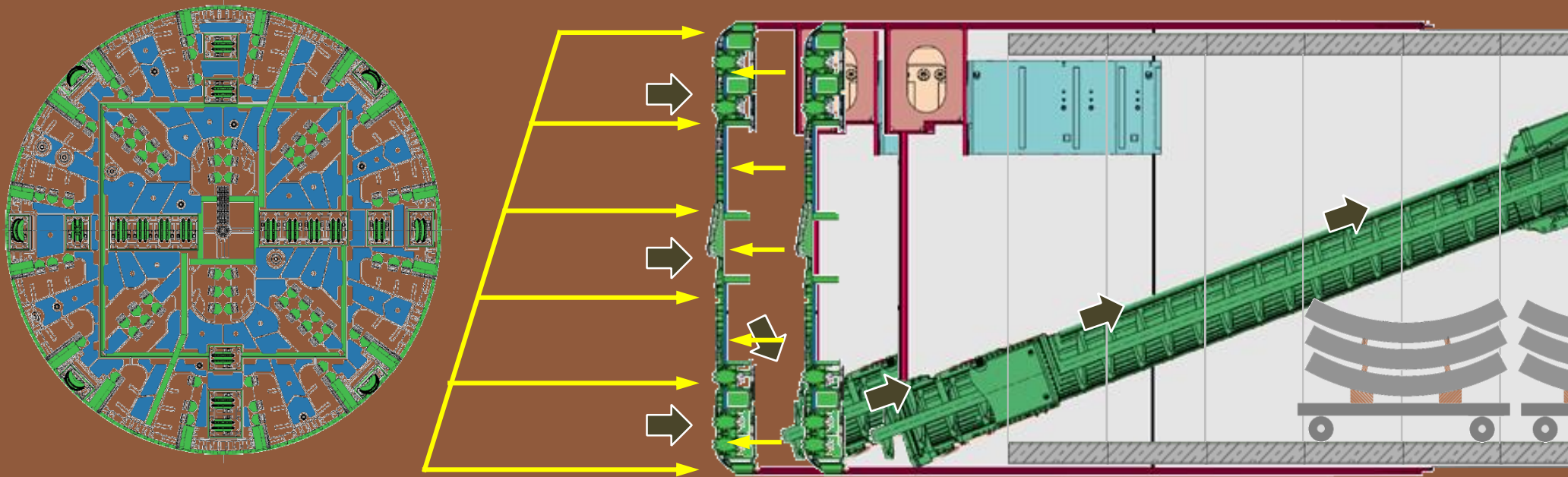


A Look Inside a TBM

Lady Bird Advances Video

A Look Inside a TBM

TBM Excavation Animation



A Look Inside a TBM

Precast Tunnel Liner Segments



Precast Segments ready for transportation to tunnel site

Segmental liner test ring build



Segment being hand finished prior to demolding

A Look Inside a TBM Tunneling Photos



TBM Utilities in conduit

Lokie (diesel powered locomotive) Inside Blue Plains Tunnel

Continuous conveyor belt for excavated soils removal



Inside Lady Bird

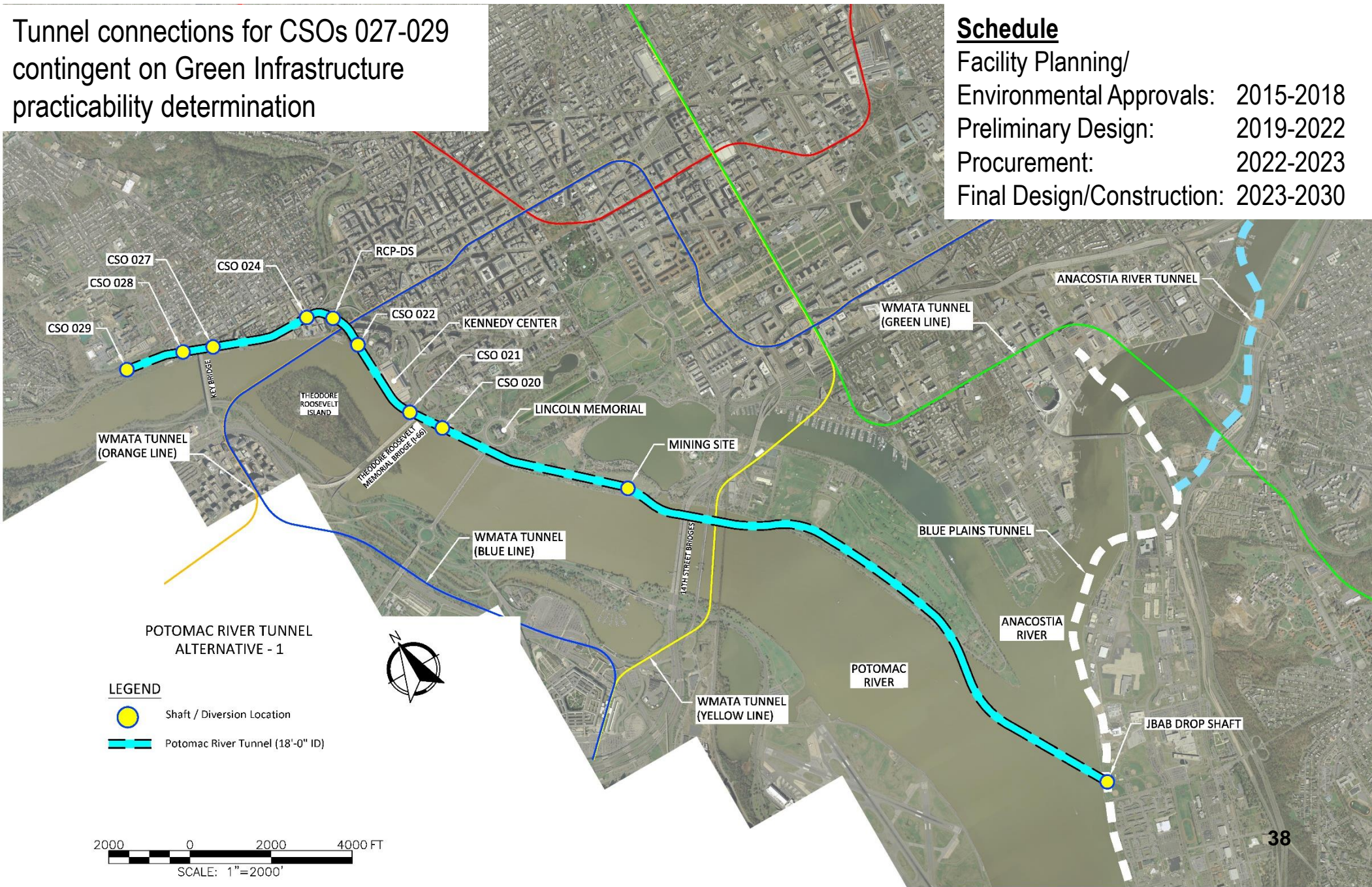
POTOMAC RIVER TUNNEL

Potomac River Tunnel

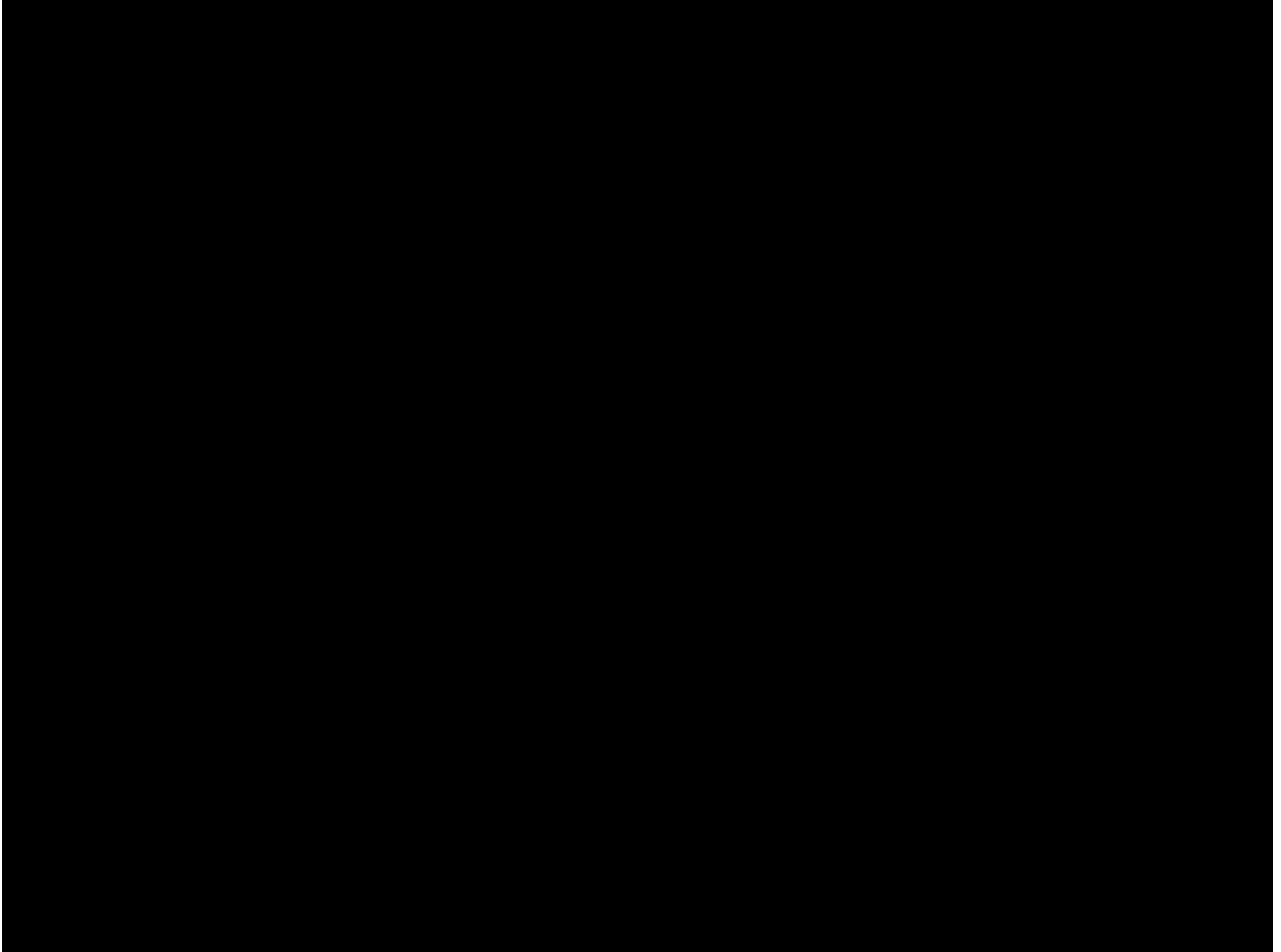
Tunnel connections for CSOs 027-029
contingent on Green Infrastructure
practicability determination

Schedule

Facility Planning/
Environmental Approvals: 2015-2018
Preliminary Design: 2019-2022
Procurement: 2022-2023
Final Design/Construction: 2023-2030



A Drop's Life Video



QUESTIONS?

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